In the marine industry, vessels and offshore installations typically have an electrical room providing power distribution throughout the facility. The power distribution system typically includes high-voltage, metal-clad switchgear; low voltage switchgear; cast resin transformers; and panel boards. A fault or failure in any one of these components can result in power outages, loss of operation, and even fire or explosions.

A temperature rise or spike on the surface of electrical components, such as switchgear busbars can be a leading indicator of an equipment problem. Being aware of these temperature changes means system diagnostics can be carried out and service planned with no interruption to normal operation – saving money in time and resources (Figure 1).

Temperature measurement

Why is temperature such a critical measurement for marine operators? Overload, phase imbalance, power factor, corrosion and poor electrical connections all contribute to the generation of heat, which is an indication of loss of energy and wasted power. Heat also contributes to a shortening of equipment life by up to 85%. These conditions may develop slowly over time or can result from a catastrophic fault.

The primary reasons for inspecting switchgear cabinets are to: reduce downtime from electrical failures; increase equipment reliability; comply with insurance requirements and government regulations; lower maintenance and repair costs; prevent system failures; and lower risks from arc flash.

In electrical power distribution, a busbar is a strip or bar of copper, brass or aluminum that conducts electricity within a switchboard, distribution board, substation, battery bank or other electrical apparatus. Its main purpose is to conduct electricity, not to function as a structural member.

Most marine power distribution systems are inspected by infrared (IR) survey on a periodic basis. These surveys are intended to identify electrical connection ‘hot spots’ so they may be repaired before failure occurs. Electrical connections always degrade over time as a result of heating and cooling, moisture, salt air, and so on.

Industry safety regulations restrict direct access to switchgear cabinets for thermographic ‘snapshots’ of busbars and other components. An approved procedure

Early detection of heat-related faults and failures in electrical equipment on a vessel or offshore installation can save owners and operators both time and money

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FIGURE 1: Typical switchgear bay
Busbar Temperature Monitoring

for disabling safety interlock is also required for direct current and voltage measurements. Thermal images may be taken through a special glass window, but this makes it difficult to assess the true condition of electrical equipment. Plus, a thermal imaging snapshot of heat generation represents one second out of a 24-hour operational cycle. If the system is not under full load, the snapshot technique may not reflect the typical or designed operational condition (Figure 2).

Many marine maintenance professionals recognize continuous monitoring of electrical equipment as a preferred alternative to periodic IR inspection. A continuous monitoring system can provide both trend analysis for predictive maintenance and instantaneous alarms for fault conditions. Predictive maintenance is a proven method of prolonging the life and efficiency of critical equipment, and avoiding unplanned shutdowns. A trend detected during continuous monitoring will allow for maintenance of the equipment at a convenient time to minimize downtime.

Effective equipment monitoring

In applications throughout the marine industry, non-contact IR temperature measurement technology has proven to be the most effective tool for continuous temperature monitoring. An IR-based system provides safe, non-contact measurement of real-time busbar temperature without the need for sensor windows or other intrusion into equipment cabinets.

Infrared thermometry suppliers have developed advanced equipment monitoring systems that provide round-the-clock condition monitoring of actively powered components or operating machinery in support of predictive and preventive maintenance programs. These systems act as an early warning device that provides live temperature data to operators, allowing them to make educated decisions regarding the functionality of their equipment (Figure 3).

Developed with personnel safety in mind, non-contact equipment monitoring systems enable temperatures to be read from a safe location. They provide a continuous temperature measurement displayed on a control module and/or remotely through PC-based software. Operators can program audible alarm settings into the system or communicate remotely from a central location via serial interface and Windows software. They can also simultaneously view and set early warning alarms on multiple monitoring points. These early alarms provide the time needed for further investigation or maintenance by qualified personnel.

Non-contact IR monitors are designed to employ compact IR point sensors to fit in tight, hard-to-reach or enclosed locations, and to monitor temperatures ranging up to 600°C. Special optics allow sensors to be safely mounted within the cabinet at a distance from the busbar to avoid flashover and electrical magnetic interference. Output signals are typically fed into a central control system. The most common applications for high-voltage switchgear busbar monitoring with IR technology use six point sensors, one for each phase, input and output (Figure 4).

The latest non-contact equipment monitoring systems enable operators to record and store data for trend analysis; remotely adjust sensor parameters; customize screen views; change sensors from reading object to ambient temperature; change emissivity; and turn filters on/off to scale the range, graph or average.

Conclusion

For marine industry owners/operators, early detection of heat-related faults and failures in electrical equipment, along with maintenance performed as needed and not when estimated, results in reduced maintenance costs and less waste from unexpected downtime.

About the author

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